The Environmental and Energy Sector and Agricultural Biotechnology

JEFF GAIN
AARC Corporation/USDA
Hardin, Ill.

I have been referred to as the father and even grandfather of modern-day industrial uses of agricultural materials. In January 1985, in Columbia, Mo., Roger Mitchell and I had the first "big" debate/discussion on the industrial uses of agricultural products. This was in the period following the agricultural crisis of the late 1970's and early 1980's. The question was "Can we do something with agricultural products other than eat them or feed them to livestock and then eat them?" We needed additional non-food and non-feed uses for our excess production of agricultural crops. We had to find some new uses for this "stuff."

At a reception in Washington D.C. at about that same time, I ran into Secretary of Agriculture John Block. He asked what I would do if I were secretary and I responded that I would appoint a group to look at agriculture with a new perspective — what can we do with the stuff we grow other than use it for food and feed? We had several million excess acres at that time with which we needed to do something. Secretary Block appointed a task force called the Secretary's Challenge Forum, which led to the New Farm and Forest Products Task Force. That task force met throughout a two and a half year period. I was privileged to be a member of the group. We made a series of recommendations that ended up on Capitol Hill. I was fortunate to work with Cooper Evans, who was on President George Bush's staff for agricultural policy. The staff was supportive, and the 1990 farm bill included legislation for the establishment of the Alternative Agriculture Research and Commercialization Center (AARC) to invest in commercialization of non-food and non-feed uses of agricultural and forestry materials. In the 1996 farm bill, the AARC Center became the AARC Corporation. The AARC has made investments in more than 60, mostly small, entrepreneurial companies that use agricultural and forestry materials to make

value-added industrial products. Those products include construction and building materials, oils, lubricants and fuels, paper, landscaping, composting and plant protection materials, environmental remediation products, shipping and packaging materials, household and personal care products, and human oral health products. The list is diverse and represents categories from niche to huge markets like fuels. I will provide more details to document the reality of this industrial products opportunity. Biotechnology is not yet playing a major role in this area, but is expected to do so.

An intense education effort has been necessary to promote this industrial products opportunity for agriculture. This has involved the Congress, governmental agencies, and environmental groups. The promising story of industrial uses, including the whole area of biotechnology, has been told. It involves the participation and opportunity for growers to benefit or profit beyond traditional mass-produced raw material kinds of markets; the full use of our arable land; the replacement of imported materials such as petroleum with domestically produced plant materials; the creation of new jobs in rural areas and associated rural development; and the environmental benefits of using plants rather than petroleum. The AARC's mission and strategic plan addresses this area in greater detail.

Let me put a historical perspective on industrial use of agricultural materials. These efforts were initiated in the 1920s, 1930s, and 1940s by Henry Ford, Thomas Edison, and Billy Hale, who married Mr. Dow's daughter (of Dow Chemical), and Wheeler McMillan, who was the well known publisher of the *Farm Journal*, a prolific writer, and overall interesting guy. McMillan, who was 98-years-old, spoke at a meeting in Washington in the late 1980's. He gave one of the most dynamic presentations that I have ever heard. In 1933, that group representing the Chemergy Council, came to Washington and tried to establish some permanent farm legislation to give an industrial agricultural approach to farm programs. They tried to mandate 10 percent use of ethanol — does that sound familiar? The American Petroleum Institute was formed about that same time. We have gone in the direction of teaching and emphasizing petroleum in our universities and have almost eliminated any emphasis on the use of plant or bio-based carbon. Our national energy policy needs to refocus from almost exclusively coal, petroleum, and gas to a reemphasis on bio-based materials.

The reemphasis has started. We're finding a lot of information on the shelves of laboratories like the USDA Regional Laboratory in Peoria, Ill., in companies, and various other places. Some of it is being developed, but it is not known because of the confidentiality concerns. It is exciting to see that finally we're getting underway. I believe we're beginning to find ways to put rural America and agriculture back to work in a meaningful rural economic development program. I want to give you a few specific examples.

We have formed a group called the North American Industrial Hemp Council, and we have made very serious efforts to keep the “recreational” users out

of it. It is a significant example of a rare opportunity for agriculture. Industrial hemp is not used as a source of marijuana. Marijuana comes from a different hemp plant, not the one grown during WWII for industrial use. Industrial hemp produces a fiber that can be used to make paper and clothing. Because of the unfortunate association of marijuana with hemp, there are legal restrictions that prohibit its growth but allow its sale in the United States, and allow its growth, but not its sale, in Canada.

We need to take a serious look at those issues. If New Jersey wants to do something, let me talk to you about generating a bill for your legislature. We have done four of them this year — Colorado and Missouri did not make it, but Vermont and Hawaii passed bills. Essentially those bills permit test plot production to provide material for evaluation of uses, how to handle it, and how to market it — all the questions that need to be answered for a new crop and marketing of its products. The Drug Enforcement Agency (DEA) says that you cannot grow it unless you have a cyclone fence and guard towers and searchlights.

Let me tell you about the opportunity for a crop like hemp. I'm working on behalf of the AARC Board with a former U.S. senator who represents a company that manufactures the interiors of vans and automobiles, like side panels and dashboards. They use a wood fiber from Spain and they don't like it. It's not the quality they want plus it doesn't meet Detroit standards for a "green" car by 2002. Ford Motor Company says we want ours by 1999. This company is the sole supplier of those parts for Ford, General Motors, Chrysler, Honda, and Toyota. They are looking at kenaf, which is a tropical crop; hemp also meets their needs. Paper may be another opportunity for hemp. It's increasingly unpopular to cut down trees to make paper, and we're using more and more paper. The demand is up and rising in the paper industry. International Paper has a member on the Board of Directors of the North American Industrial Hemp Council; they are very concerned about alternative sources of paper. They need a good, renewable, annual, large volume supply of a quality long fiber, which hemp provides. Hemp can be grown anywhere. It's also extremely resistant to disease and insects. It does require high levels of fertilization, but it anchors the soil with its great root system. It reduces the need for pest control and it's one of the most resistant plants in the world. Norman Borllaug, Nobel Peace Prize winner, told me in St. Louis recently that he would do anything he could to help make this plant available to grow industrially because it's a fantastic plant. It's the oldest known commercially grown plant in the world. It has lots of things going for it. Does biotechnology have a role to play in hemp?

In the AARC we are seeing the commercialization of agriculture products that appear to have significant positive environmental impacts, as well as agricultural and economic development impacts. One example is a product called Citrasolve being marketed by a company in Connecticut. Citrasolve is a hand cleanser made from citrus. The product may have other uses, such as control of difficult-to-control fire ants, and a university is examining that possibility.

Maybe this product could be a biodegradable kind of soap that you could spray on tomato, bean, or other plants to control pests. What are the applications of some of these products? We really don't know. What we are finding is that the more you look, the more you find.

We are also finding that marketing, not technology, is the major challenge for bio-based agriculture and forestry products. There are many opportunities and it is difficult to decide where to focus. Marketing is the biggest challenge in conducting due dilligence of projects for possible funding by the AARC. We have lots of good ideas, but it is hard to get them into the market. We usually don't have the marketing intelligence that we need.

In the energy area, liquid fuels is a major market that is currently dominated by gasoline from petroleum, more than 50 percent of which is imported. Ethanol from corn has grown to one to two percent of the gasoline market, where a mixture of ethanol and gasoline is sold as gasohol. In the long-term, a combination of waste paper, straw, residues, and a crop such as switch grass grown for biomass may provide ethanol that is cost competitive with liquid fuels from petroleum. The pollution laws in certain states make it necessary to find ways to use/get-rid-of straw because it cannot be burned and there is too much to plow under. Ethanol production from those kinds of waste streams makes a lot of sense and will help clean up the environment. AARC has made investments for commercialization of ethanol from biomass and biodiesel. Some biobased industrial products need technical advances to be economic, as does ethanol, while others are economic and need production and marketing input.

In the 1980s I thought that economics would be the biggest problem. I don't think so anymore. Lubricants from plants are an environmentally favorable example. Crankcase oil for engines and oil for chain saws, outboard motors, and hydraulic fluid lines are being made from plant oils. Because the plant-based ones are more biodegradable than petroleum based ones, we are going to be required by law, like in Europe, to use them. Some biobased industrial products are going to be driven by environmental requirements and others are going to be driven by the pure economics of the marketplace. We need to project what those opportunities/needs will be so that agriculture and forestry material use can be maximized.

My grandparents and parents composted everything and they had fewer pest problems. We are relearning the benefits of composting. AARC has funded Earthgro to commercialize a compost that has disease suppressive ability and reduces need for chemical fungicide sprays. This product has added economic value and is favorable to the environment.

Of the about 30,000 plants that are known, agriculture has only domesticated and used about 30. Soybeans is a new crop to the U.S. that has become very important, and canola is a genetically modified crop that has become important

in Canada. Why don't we have more crop alternatives? There is a lot of opportunity out there for new crops and products from them. The more I look, the more I'm convinced of this opportunity. AARC has made some investments in new crops such as Syrica (milkweed) and kenaf, also for their fiber.

The Defense Department is a driver because of national security and because of its increasing emphasis on the environment. It is essential to make linkages to those interests outside of agriculture. Those linkages are essential to marketing. The size of the United States, in contrast to Japan, will enable us to develop approaches to things here that are not possible for countries like Japan. The United States has the acreage to support biobased liquid fuels while countries like Japan do not. But we must establish linkages with major groups outside of agriculture to meet the challenges.

Let me close with a factual statement about plants. I will use corn as a plant example. You can make anything out of a bushel of corn that you can make out of a barrel of crude petroleum oil. The former is renewable, the latter is not. The processes for corn are different than those for petroleum. Petroleum now dominates energy and chemicals. We need to refocus use of plants such as corn for those products. The plant route will be more favorable to the environment and to rural growth and economic development. Biotechnology has a significant role to play in this redirection.